Severe Weather and the inverted V sounding in New York and Pennsylvania

Mike Evans NOAA / NWS Binghamton, NY

Barry Lambert NOAA / NWS State College, Pa

1. Introduction

Environmental temperature and moisture profiles characterized by steep lapse rates and decreasing dew point depression with height in the lower troposphere, capped by a moist layer in the mid troposphere, are known as “inverted V” profiles (Beebe 1955). Convective storms forming in these environments frequently produce strong to severe convective wind gusts resulting from the evaporative cooling and strong downdraft potential associated with such a profile (Bluestein 1994). Wakimoto (1985) found that the inverted V thermodynamic profile is an important environmental precursor to dry microbursts over the high plains of the central U.S.

The occurrence of severe convective wind storms associated with dry lower-tropospheric conditions over the eastern U.S. was studied by Corfidi et al. (2006). Twelve cases were examined based on data availability and knowledge of the events by the authors. Several of these events occurred in the mid-Atlantic region, with 4 events occurring in Pennsylvania, the Delmarva area, or Virginia. No events were documented farther north across New York or New England. In addition to dry low-levels and steep low-level lapse rates, these events were characterized by convective available potential energy (CAPE) values lower than what is typical in significant severe weather outbreaks over the eastern and central U.S., making them a challenge to forecast . These systems were typically initiated by strong mesoscale forcing for ascent, and were maintained by a thermodynamic and kinematic environment favorable for downdraft-dominated, forward propagating convective wind storms. The systems appeared to be composed of “bands of downwind-directed microbursts”, with propagation playing a disproportionately strong role in system movement relative to advection.

The purpose of this study is to build on previous work on convective systems occurring in environments characterized by inverted V thermodynamic profiles, by taking a comprehensive look at these events within an area limited to New York and Pennsylvania . A local climatology of these events

will be shown, with events including both significant severe weather outbreaks, and null events. The focus on New York and Pennsylvania will give local forecasters an understanding of the environments that characterize these events within the local area, and an appreciation of the local climatology and impacts associated with these events.

Section 2 of this paper will discuss data collection and methodology issues. Results are summarized in section 3. Section 4 will show case studies of significant convective events occurring in New York and Pennsylvania, as well as a null event. A summary and conclusion is given in section 4.